No originality is, of course, claimed for this system of labeling, but the writer does not happen to know of its being used elsewhere for chemical specimens. Any one may easily devise letters and numbers to fit his present collection as well as future additions. Provision may be made for alloys, commercial samples, and the like, wherever necessary.

It is convenient to write the letters and figures in two lines, library style, as, "S 6" is written large with the "th 2" written small, beneath. Three figures, with the initial, will be the maximum number of characters in the first line. For the lower line, the rule is not to use more than three letters, while two figures will always be sufficient.

The bottles used in the writer's collection are one-pound and half-pound "salt mouth," of uniform style, with "mushroom" stoppers. These are convenient sizes, the smaller size being used mainly for the more costly substances. There are two labels on each bottle. The larger labels are known to the trade as No. 1006, about four by one and five eighths inches. The names of the substances are printed on these labels with rubber type in capital letters a quarter of an inch high. These labels are placed just below the shoulder of the bottle. The round labels used for the index letters and numbers are known as "A 88" or library labels. These are centered under the large label near the bottom of the bottle. A library assistant did the lettering of these labels, using india ink. The bottles are sealed with paraffin, and the labels coated with paraffin. The latter is necessary as the bottles are kept on open shelves, and usually require wiping with a damp cloth when they are to be shown. The paraffin further protects the labels against accidental contact with acids or alkalies.

This system of labeling is scarcely applicable to organic compounds, unless one does not wish to keep them separate from inorganic. The writer, for present purposes, has made a list of the substances studied or referred to, in order, in the organic text used (one of the most complete published), and each substance given a number. This does not include substances that are impracticable to keep or procure. The collection is so arranged that the substances mentioned in a given chapter are found together, in numerical order, the missing numbers to be supplied in the future. Another possible arrangement is by classes of compounds. This has been used, but is rather less convenient than the present arrangement. In the organic set, the half-pound bottle is the maximum size for solids, the two-ounce the minimum. For liquids, there are three sizes, from a half-liter down. The labels are No. 1007 for the names, and No. 539 for the numbers. The bottles are paraffined as in the inorganic set. On account of the effect of light on many organic compounds, the specimens are kept in a dark room, where the inorganic set is also kept for convenience.

The "looks" of one's teaching devices will be certain to leave lasting impressions on the observer. This is especially true in the chemical laboratory and lecture room. While it is not claimed that the above-described methods of labeling bottled chemical specimens are the best that could be devised, they have served the writer very well and it is hoped that the description may interest others.

C. E. VAIL
COLORADO AGRICULTURAL COLLEGE

REPORT OF THE SAN FRANCISCO MEETING OF SECTION F OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. II

Thursday, August 5

Morning Session, Demonstrations

In charge of OLIVE SWEZY, University of California

Entamœba Buccalis, Inez F. Smith, University of California.

Mitosis and Multiple Fission in the Flagellata, Olive Swezy, University of California.

Mitosis in *Lamblia muris,* Elizabeth Christiansen, University of California.

Enflagellating and Exflagellating Soil Amœba, Charlie W. Wilson, University of California.

Flagellates of Hemiptera, Irene McCulloch, University of California.

Drawings for Monograph on Dinoflagellata, C. A. Kofoid and Mrs. Rigden-Michener, University of California.

Drawings for Monograph on Pacific Tintinnoidea, C. A. Kofoid and Mrs. Elizabeth Purington, University of California.

Balantidium from the Pig, J. D. MacDonald, University of California.

Drawings of Elasmobranchs, J. Frank Daniels, University of California.

Papers: Protozoology

CHARLES A. KOFOID, University of California, presiding

Chromosomes in Protozoa: MAYNARD M. METCALF, Oberlin, Ohio.

This review has endeavored to show that in each group of the Protozoa are found elongated chromosomes which are linear aggregates of granules and which split longitudinally in mitosis, giving exact equivalence of the daughter nuclei. In all major groups, except perhaps the *Mastigophora,* presexual and sexual phenomena, essentially similar to those of *Metazoa* are known. The Metazoan mechanism of inheritance is therefore present, in some representatives at least, of all the great Protozoan groups. It has shown also that, in some representatives, at least, of the *Plasmodrome,* during the vegetative phases of the life history, the chromatin outside the caryosome, indeed apparently outside the caryoli, is thrown off as trophical chromidia. Such evolution of complexity of organization as has occurred in the *Metazoa* probably could not occur until, as in the *Ciliata,* a considerable amount of chromatin is kept intact throughout the whole life history, including its vegetative as well as its presexual and sexual phases. The lower Protozoa have the Metazoan type of mechanism of inheritance in connection with their sexual phases but can not utilize it for the development of a complex series of determiners for elaborate structural organization, for they do not keep this mechanism intact during their vegetative periods. The higher Protozoa apparently have the Metazoan type of mechanism of inheritance and keep it intact through all their life cycle. To what extent they have utilized its presence to develop determiners, is an interesting question which does not seem beyond experimental study with favorable material.

Problems on Rejuvenescence in Protozoa (illustrated with lantern slides): LORANDE L. WOODRUFF, Yale University (read by title).

The Evolution of the Protozoan Nucleus and Its Extranuclear Connections: CHARLES ATWOOD KOFOID, University of California.

The essential and fundamental similarity of Protozoan and metazoan nucleus is indicated by the general trend of recent cytological investigations among the Protozoa. The process of mitosis has the same sequence of phases, though the chronology of mitotic events and of the division of extranuclear structures varies from species to species and also among individuals within the species. In the early prophase in trichomonad flagellates and in *Nægleria* the chromatin aggregates, presumably chromosomes each split longitudinally, or the chromatin network forms a split skein or thread which later fuses into one, or emerges on the equatorial plate in chromosomes in which the precocious splitting has entirely disappeared. The chromosomes are definite in number and are differentiated among themselves as to size and behavior in mitosis. There are suggestions of odd and even numbers (4, 5) there is (in Trichomonad flagellates in several genera and species) a small chromosome lagging in the metaphase, and there are instances of unequal division of chromosomes.

The blepharoplast contains the centrosome in trichomonad flagellates or is attached to it (*Giardia-Lamblia*). This organelle should not be called a kinetonucleus; Schaudinn's report of its heteropole origin by mitosis is unsupported and probably invalid. It arises in enflagellating *Nægleria* (*-Amœba*) *gruberi* from the centrosome or centriole in the central caryosome, which sends out a radial fibril which enlarges at the periphery into a blepharoplast at the base of the two flagellæ which grow out from this enlargement. In exflagellation the flagella withdraw and together with the blepharoplast retreat into the caryosome. The blepharoplast is highly developed in parasitic flagellates and is directly connected by a system of fibrils with nucleus, flagella, axostyle and parabasal body, the whole forming an integrated structural unit which functions as a neuromotor apparatus comparable with that of the ciliate *Diplodinium.* It is a specialized structure developed to the greatest extent in connection with parasitic life demanding unusual expenditure of energy in locomotor activity. The term kinetonucleus should be abandoned as misleading. The Binuclearity Hypothesis in its nuclear implications has no adequate foundations, and the order Binucleata should be discarded. The parabasal body of flagellates and *Trichonyphida* is perhaps the analogue of the macronucleus of the ciliates and is an extranuclear store of the chromatin related to the needs of flagellar and ciliary activities.

Afternoon Session Papers: Geographic Distribution
JOSEPH GRINNELL, University of California, presiding

California as a Testing Ground for Theories of Distributional Control: JOSEPH GRINNELL, University of California.

Insect Transmission of Swamp Fever: J. W. SCOTT, University of Wyoming.

During the summer of 1914, the writer obtained experimentally a well-defined case of swamp fever, and the conditions of the experiment leave no doubt that the disease was contracted through the agency of certain biting insects. This disease, frequently known as "infectious" or pernicious anemia, is a serious and destructive blood disease of the horse. It has been reported from France, Germany and Japan, and is widely distributed in North America, from Texas to the Northwest Territories, and from the states of Washington and Nevada to the Province of Ontario, Canada. It has an altitudinal distribution from near sea-level to at least 9,000 feet. It is usually found in swampy regions, but has also been reported from rolling, wooded countries. Wherever found, it may become epidemic and cause the loss of a large percentage of a given herd of horses. The disease shows a seasonal distribution, reaching a maximum number of cases in late summer or early autumn. The disease itself is characterized by progressive emaciation and an intermittent rise in temperature; it is frequently accompanied by anemia, and the rises in temperature are sometimes at quite regular intervals. The organism is filterable, for the disease is transmitted by the injection of blood serum after it has been passed through a Berkfeld filter.

In France, Vallei and Carri concluded that natural transmisson took place through drinking water contaminated with urine or feces from an infected horse. Van Es, of North Dakota, in 1911, after a study of several years, thought this the most probable explanation. Swingle, however, in Wyoming, in 1912 and 1913, showed that it was an extremely difficult matter to secure infection by way of the alimentary canal, his numerous experiments with urine and feces all resulting negatively.

At this point in 1913 the writer began the problem. Since internal transmission was a difficult matter, only one or two cases being known (Van Es, Schlatholter), and since the contamination of drinking water could hardly explain epidemics, it was believed that natural transmission must be by means of some external agent. Accordingly in the spring of 1914 a screened cage was erected capable of holding five horses. The cage had an entryway 10 feet long, each end closed by a door and the screen had 16 meshes to the inch.

The first experiment in this cage was with various kinds of mosquitoes and resulted negatively. A longer and more conclusive experiment with mosquitoes the present summer has had a similar result. There was next introduced into this cage a considerable number of flies; these were houseflies, stable-flies and a few other wild flies, including one of the smaller species of Tabanids. The house-flies and stable flies thrived and increased rapidly in numbers between the first and the twenty-fifth of August; the other flies soon died and were not observed to attack the horses. The stable-flies were observed to feed in large numbers on both infected and well horses. Except for two or three days infected horses were kept continuously in the cage from July 27 to August 28. Three well horses were exposed in the cage during this time. On August 28 horse No. 22, a healthy strong animal, showed a temperature of 102.8. After two more fever periods this horse died October 5. Subinjection of his blood has produced typical cases, showing that he had the disease. The temperature of this horse had been normal from June 9 to August 28, and he had not been outside of the cage for 25 days, while 10–14 days is the ordinary incubation period of the disease. Under these conditions there appears to be no escape from the conclusion that insects transmitted the disease. It is believed further that the stable-fly was responsible for the transmission for the following reasons: (1) These flies were observed to attack the horses viciously. (2) Negative results of two other experiments show that the mosquitoes were not responsible, even though a few were still in the cage during August. (3) Houseflies do not bite, and the other flies present in the cage did not attack the horses, so far as one could observe, and soon died.

The experiment, with the stable flies alone, is being repeated, and another experiment involving some of the Tabanidæ is also in progress.

The Big Bears of Western North America, with Special Reference to their Distribution: C. HART MERRIAM, United States Biological Survey.

The bears are the largest of living carnivores and are widely distributed, being found in both Americas and in Eurasia. The typical genus *Ursus* occurs in both eastern and western hemispheres. South America is the home of *Tremarctos,*

a short-faced bear resembling *Arctotherium*, of the American Pleistocene, while the north polar regions are inhabited by the polar bear, *Thalarctos*. The ancestry of the bears is still clouded, none being known below the Pliocene.

Systematically the bears are a compact group, yet within the genus *Ursus* several subgroups may be recognized; the subgenus *Euarctos*, containing the black or cinnamon bears and the subgenus *Ursus*, containing the grizzly and brown bears. Of the latter (grizzly and brown bears) two, three and even four species, representing different species-assemblages, may be found in a single locality, as in the fossil deposits of Rancho La Brea or in Yellowstone National Park. The characters used in identification are chiefly cranial and dental. Skulls of males of the grizzly group are two, and in some cases, three times the bulk of those of females of the same species. At present about 40 species of grizzlies and 10 of brown bears are recognized, where formerly but one of each was known. For example, California once contained representatives of five different groups of grizzlies. The recognition of this large number of species has been made possible by the extensive collections of skulls in the United States National Museum and in the California Museum of Vertebrate Zoology.

Fossil Tertiary Mollusca of the Rocky Mountain Region: T. D. A. Cockerell, University of Colorado, Boulder, Colorado.

The recent expeditions of the American Museum of Natural History, primarily for the discovery of mammalian remains, have brought to light some very interesting Tertiary land and freshwater shells, principally in Wyoming and New Mexico. From a study of these we are led to the following conclusions:

1. Certain of the most characteristic genera of the Rocky Mountain land shells living to-day are apparently very ancient inhabitants of the same general region, and have, perhaps, at no time extended very much beyond it. The most noteworthy example is *Oreohelix*, represented in the Eocene and Paleocene by large species, some of the specimens showing the sculpture of the apical whorls, which agrees with that of the group called *Radiocentrum* by Pilsbry. A species of *Holospira* from the New Mexico Paleocene is extremely like a living species of Arizona.

2. *Ashmunella*, one of the most characteristic endemic genera of the southwest, is not at present known below the Pleistocene. It is not possible to be sure, at present, whether all the peculiar genera of the Rocky Mountain region and southwest are very ancient inhabitants of that country, but it seems very likely that they will all be found, sooner or later, in the early tertiaries.

3. Various circumpolar genera of small snails, such as *Pupilla* and *Cochlicopa*, represented in the modern fauna by species identical or nearly identical with those of Europe and northern Asia, are apparently lacking in the Tertiary, or at any rate in the Eocene. They may have been overlooked, but it is probable that they have reached our region in much more recent times, from Eurasia, as their small amount of modification, or total lack of it, would suggest the Eocene collections do contain small species of more characteristically American types as *Vitrea* and *Thysanophora*.

4. The Paleocene and Eocene faunas included a series of genera entirely different from anything now living in the same region, but evidently related, at least in part, to the present Central American and West Indian faunas. Thus we have from the Eocene of Wyoming species apparently referable to *Pleurodonte* and *Eucalodium*. It is not clear, at the present time, whether this Central American fauna originated northward, or whether it had its main center in the region where it now exists, merely extending northward during a time when the country now represented by Wyoming and Colorado was low, moist and warm.

5. The most remarkable discoveries have been of small shells belonging to the Bulimulidæ, having the aperture or last whorl upturned, representing at least two genera (*Protoboysia* and *Grangerella*) and four species. These, while belonging to extinct genera, show evident relationship with some of the South American snails, and at the same time a remarkable resemblance to the Indian genus *Boysia*, which is supposed to belong to the Pupillida, though the anatomy is unknown.

6. Among the fresh-water shells, the Unionidæ are the most interesting. About the end of the Cretaceous and beginning of the Tertiary we find in the Rocky Mountain region a large and varied series, resembling the types which now inhabit the Mississippi Valley. At about the same time that the dinosaurs disappeared, these mussels also departed, leaving an impoverished Unionid fauna in the Eocene, which in its turn eventually died out altogether. It seems probable that this change was connected with earth movements.

Isolation as a Factor in the Evolution of Thais lamellosa (illustrated with specimens and lantern slides): Trevor Kincaid, University of Washington.

Friday, August 6

Morning Session, Demonstrations

In charge of F. W. WEYMOUTH

Living Ova of Rat in Serum, J. A. Long, University of California.

Papers: Marine Zoology

F. M. MCFARLAND, Stanford University, presiding

The Occurrence and Possible Causes of Periodic Vertical Movements of Aquatic Organisms: C. O. ESTERLY, Occidental College, Los Angeles, California.

It is well known that many aquatic organisms, particularly those of the plankton, are more abundant at or near the surface by day than by night. This is because they ascend from deeper water in the early part of the night and descend from the surface later.

In order to understand the fundamental causes of this phenomenon it is necessary to have accurate knowledge of the field conditions under which collections are made, particularly of the temperature and salinity of the water and of the light intensity as represented by the time of day at least. It is highly important that field observations be supplemented by laboratory experiment to determine to what sorts and degrees of stimuli the organisms respond. Furthermore, each species must be studied by itself.

The explanation of the diurnal movement that at present is most satisfactory is the one based on responses to different factors in the environment, but our knowledge in this respect is very incomplete. The "mechanical explanation" which takes into account mainly the changes in viscosity of the water does not satisfy. The suggestion that the alternating rise and fall is due to metabolic rhythms has received so little attention that its worth is not apparent.

Some Physiological Characters of Marine Animals from Different Depths: V. E. SHELFORD, University of Illinois, Urbana.

Field Study of Animal Behavior as contrasted with Laboratory Study: ELLIS L. MICHAEL, Scripps Institute, La Jolla, California.

The object of this paper is to emphasize the necessity of employing two essentially distinct but mutually helpful methods of research in any strictly scientific study of animal behavior. All biologists readily admit that an important function of the well-known laboratory method is that of analyzing the mechanism involved in an organism's response. Few, however, seem to realize that this method is incapable of revealing how any particular species is related to its environmental complex.

Yet, the minute a definite answer to such a question is sought, a little thought clearly shows that recourse must be had to some method of field observation. For instance, could any amount of laboratory experimenting reveal the fact that *Sagitta bipunctata* is more abundant between 15 and 25 fathoms than at any other depth, or that it increases in abundance as the distance from the coast decreases?

In order to demonstrate the indispensability of a field method three aspects of the behavior of *S. bipunctata* are illustrated in some detail. First, the variation in abundance at all depths at different times of day is considered, showing how the species migrates vertically. Second, the fact that it accumulates in all depths in greatest numbers when the temperature lies between 13° and 16° C. is revealed. Third, data are presented showing that the species is more abundant, on the surface at least, when the salinity lies between 33.55 and 33.70.

Finally, the question of the interpretation of the results is discussed. Attention is called to the fact that an adequate interpretation necessitates recourse to the laboratory method. Obviously the field method can not, except by interference, ascertain the nature of response involved, *i. e.*, as to whether the demonstrated relations are due to a tropism, a taxis, a metabolic reaction, or to a direct physical effect of changes in viscosity and a specific gravity.

The Influence of Chance on the Number of Organisms Collected in Plankton Nets: GEORGE F. MCEWEN, Scripps Institute for Biological Research, La Jolla, California.

Measurements of a number of hydrographic elements and the corresponding abundance, or number of a species per unit volume of water in the ocean supply the data for determining the way in which the distribution of the species is related to these elements.

Practically, the distribution of the smaller organisms must be inferred from the number of each species collected per haul made with a plankton net. A plankton net filters rather variable fraction of the water that would pass through the net rim, if unobstructed; also the estimate of the distance hauled is usually subject to accidental errors of importance.

Grouping values of the abundance thus obtained with respect to each of a series of magnitudes of one of the environmental elements exhibits in tabular form the relation of the distribution to that element and the others linked with it. The errors in estimating the abundance arising from the use of a plankton net, the variability of the elements other than the one in question, and the fact that only a relatively small sample of the total population is examined have an important accidental influence on the character of the relation.

Illustrations are given of a method of testing the significance of the difference between two values of the abundance, which depends upon the probability that a difference in the same direction would arise by chance if the number of hauls were indefinitely increased. A plan is briefly outlined for eliminating the effects of all but one of the elements and testing the significance of the relation indicated by the corrected values of the abundance. The same methods are also applicable to statistical treatment of other kinds of quantitative data.

The Boring Mollusca of the Pacific Coast: Mrs. Ida S. Oldroyd, Long Beach, California.

The Life History of the Pacific Herring: C. McLean Fraser.

The Pacific herring appear in large schools all along the Pacific coast from California to Alaska. The average weight of those caught in purse seines is about 3.6 oz. and the length 8 inches, not including caudal finrays. They wander about in search of food, which consists mainly of copepods. There is but one spawning season in one locality. Near the biological station, Nanaimo, this is in February and March. Spawning takes place in shallow water, but this may be incidental to the requirement of barnacle larvæ for food at that time. Both females and males rub against the sea weed while spawning. The spawn adheres, hatches out in 14 or 16 days and the yolk lasts another six days. First spawning takes place at the age of three or four years. Most herring caught are from four to eight years; some were found ten years old. The scale increases in size in approximately the same ratio as the other parts of the body and the different year growths are marked off by winter checks or rings. Those who have calculated the growth of the fish in each year from the rate of growth of the scales have failed to take into account that the scale does not start to grow when the fish does. The herring is 3.5 cm. long before the appearance of the scale. This should be taken into consideration when the length of the fish is divided according to the divisions of the scale as shown by winter checks.

The Nuclear Phenomena in Paramecium: R. T. Young, University of North Dakota.

During the San Francisco meetings on Thursday, August 5, of the American Association for the Advancement of Science, there was formed a Pacific Branch of the American Society of Zoologists. The officers elected at this meeting were:

President, V. L. Kellogg, Stanford University, Palo Alto, California.

Vice-president, R. M. Yerkes, Santa Barbara, California.

Secretary and Treasurer, Joseph Grinnell, University of California, Berkeley, California.

Executive Committee, C. O. Esterly, Occidental College, Los Angeles, California; Barton W. Evermann, California Academy of Science, San Francisco, California; Charles L. Edwards, Los Angeles, California; J. Frank Daniel, University of California, Berkeley, California; Harold Heath, Stanford University, Palo Alto, California.

On Thursday, August 5, there was formed a Pacific Coast Branch of the American Society of Naturalists with the following organization:

President, Barton W. Evermann, California Academy of Sciences, San Francisco, California.

Vice-president, John F. Bovard, University of Oregon, Eugene, Oregon.

Secretary, Ellis Leroy Michael, Scripps Institute for Biological Research, La Jolla, California.

Treasurer, L. L. Burlingame, Stanford University, Palo Alto, California.

Executive Committee, Trevor Kincaid, University of Washington, Seattle, Wash.; Harry B. Torrey, Reed College, Portland, Oregon; Frank M. McFarland, Stanford University, Palo Alto, California.

The society will take the place of the local biological societies of the Pacific coast.

The Biological Society of the Pacific met at the Hotel Sutter, San Francisco, August 4, for their annual meeting. The address of the evening was given by Dr. Harry Beal Torrey, of Reed College, on "Research and the Elementary Student of Science." At this meeting the Biological Society voted to drop its organization in favor of the newly organized Pacific Branch of the American Society of Naturalists.

H. V. Neal,
Secretary